presents

the SOSbox

COMPANY PROFILE

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- **Jackson Connolly (**CIO)

OBJECTIVES

1. Motivation
2. Background
3. System Design (Hardware/Software)
4. Schedule
5. Budget
6. Market Potential
7. Conclusion

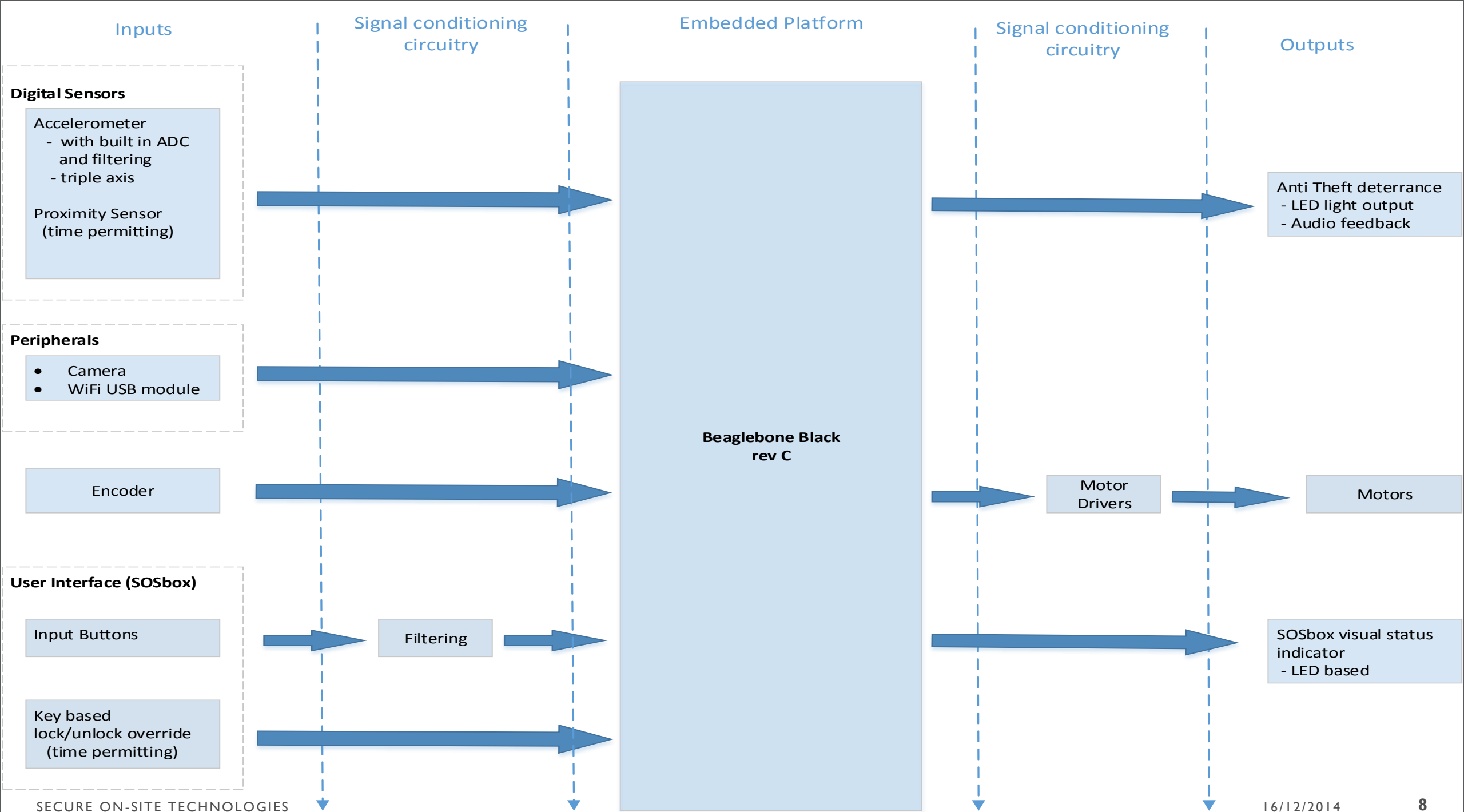
MOTIVATION

- Our project addresses inefficiencies that exist in the current parcel delivery model.
- Using an embedded platform, smartphone devices and we can empower couriers to deliver parcels at anytime

BACKGROUND

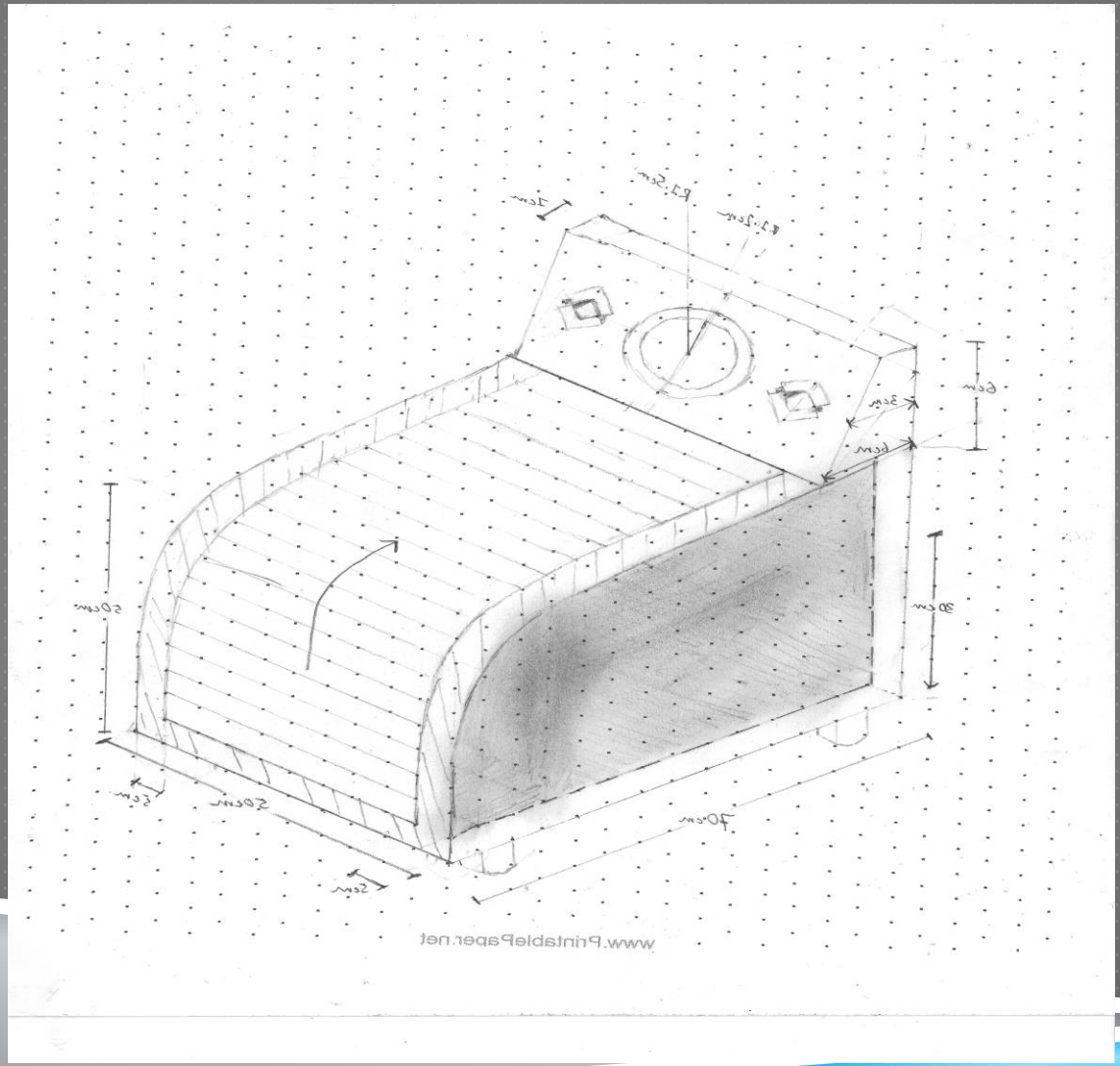
- **The goal of our project: Address a real world problem**
  - In cities with low population density, parcel items are often taken back to retail locations or even distribution centres more than five kilometres away from the recipient's home when attempts of in person parcel delivery are unsuccessful.
  - Our team has solved this problem by designing and building a secure IoT-enabled outdoor parcel collection system called the SOSbox.
  - The SOSbox solution will allow customers to receive parcels at home through their smartphones without having to be home during time of delivery by the courier company.
  - Furthermore, the system would incorporate package recognition technologies and security features such as remotely controllable video surveillance and theft deterrence capabilities.

HIGH LEVEL SYSTEM DIAGRAM

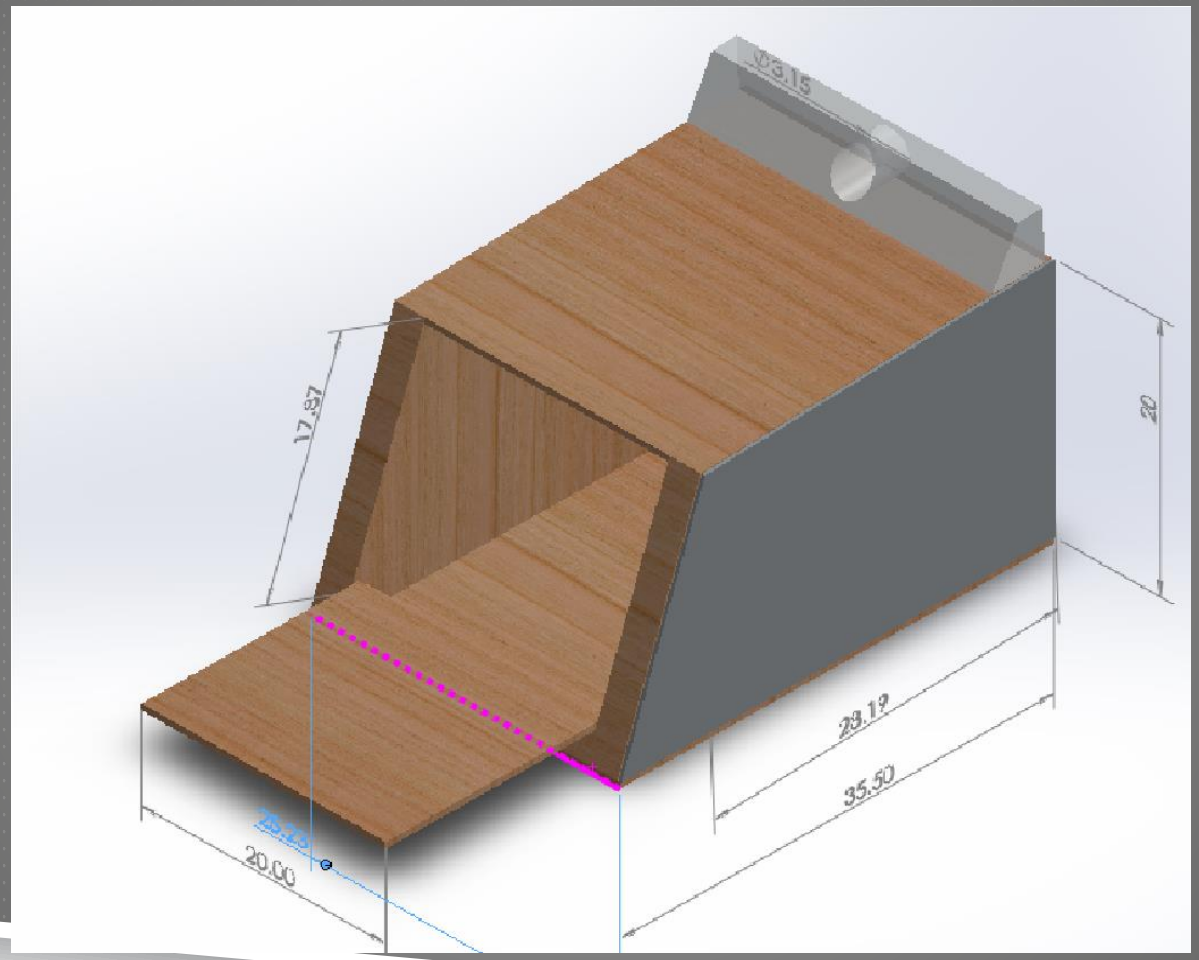

Inputs
Signal conditioning circuitry
Embedded Platform
Signal conditioning circuitry
Outputs
Digital Sensors
Accelerometer
- with built in ADC and filtering
- triple axis
Proximity Sensor (time permitting)
Peripherals
Camera
WiFi USB module
Encoder
User Interface (SOSbox)
Input Buttons
Filtering
Key based lock/unlock override (time permitting)
Beaglebone Black rev C
Anti Theft deterrance
- LED light output
- Audio feedback
Motor Drivers
Motors
SOSbox visual status indicator
- LED based

HARDWARE

SOSbox Design 1.0



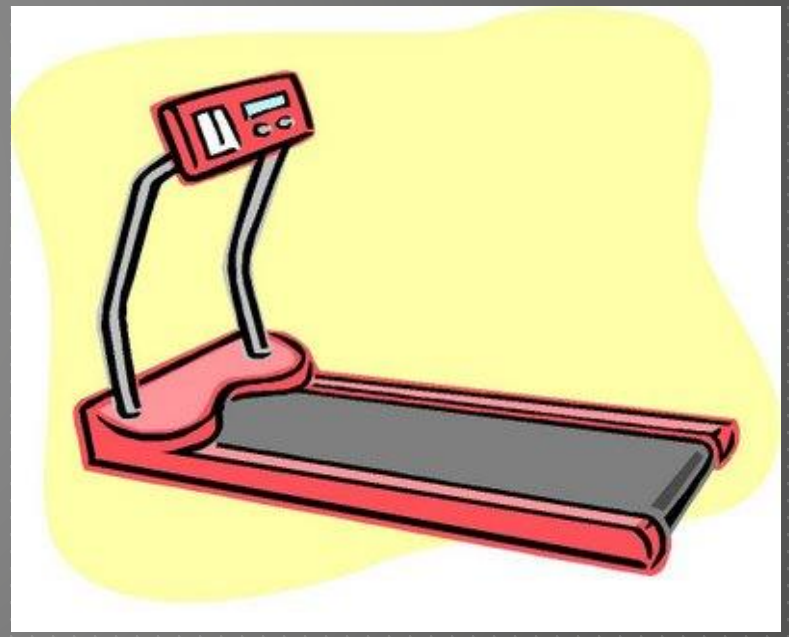
SOSbox Design 1.1

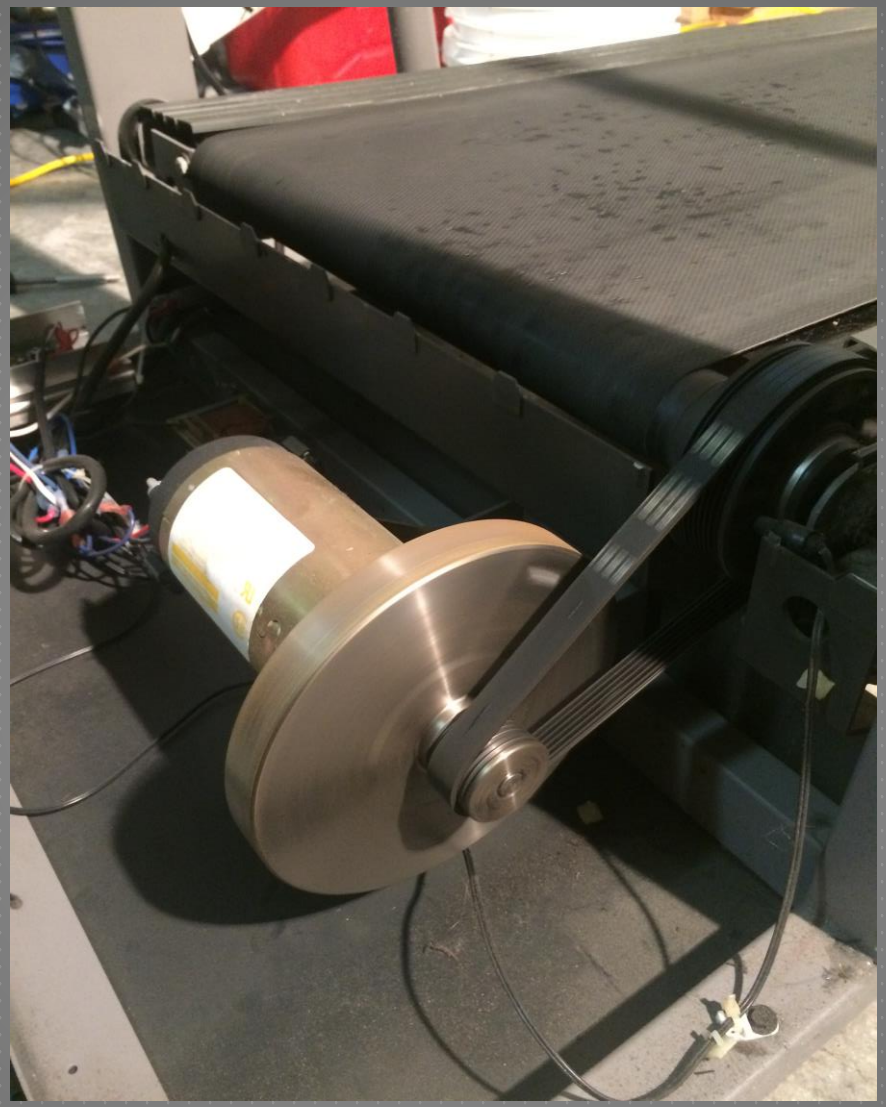


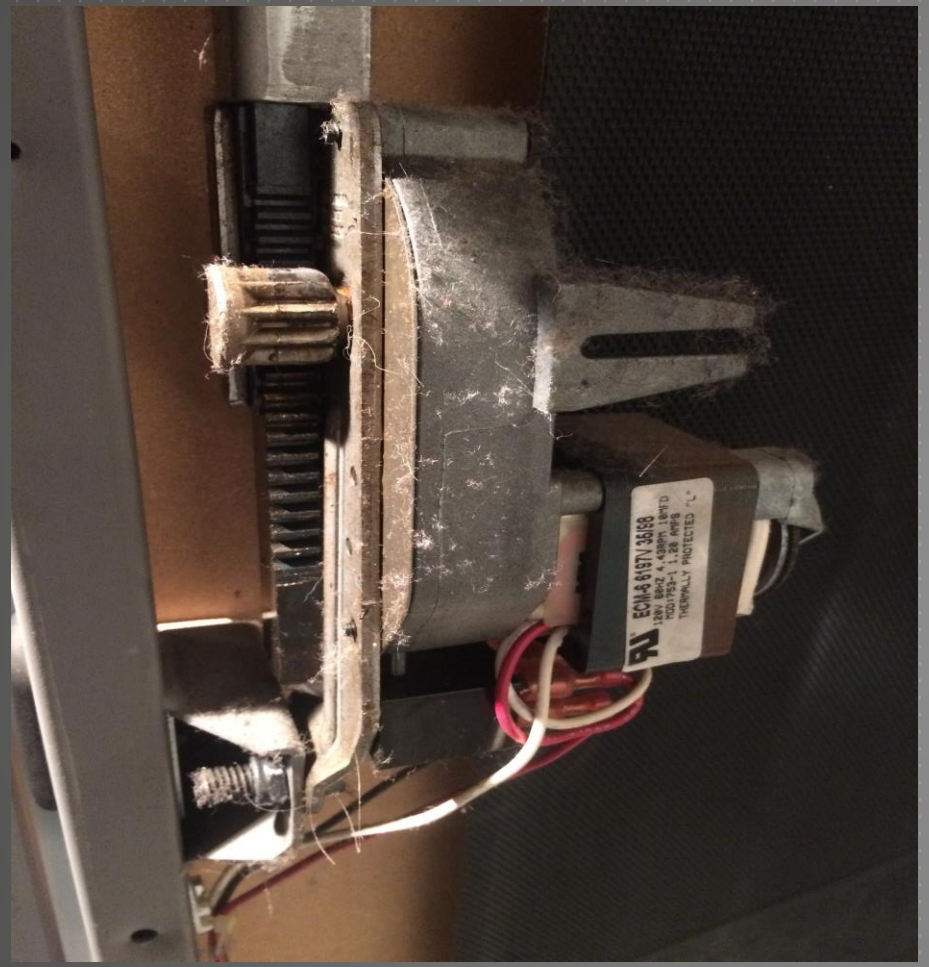
SOSbox Design 1.2

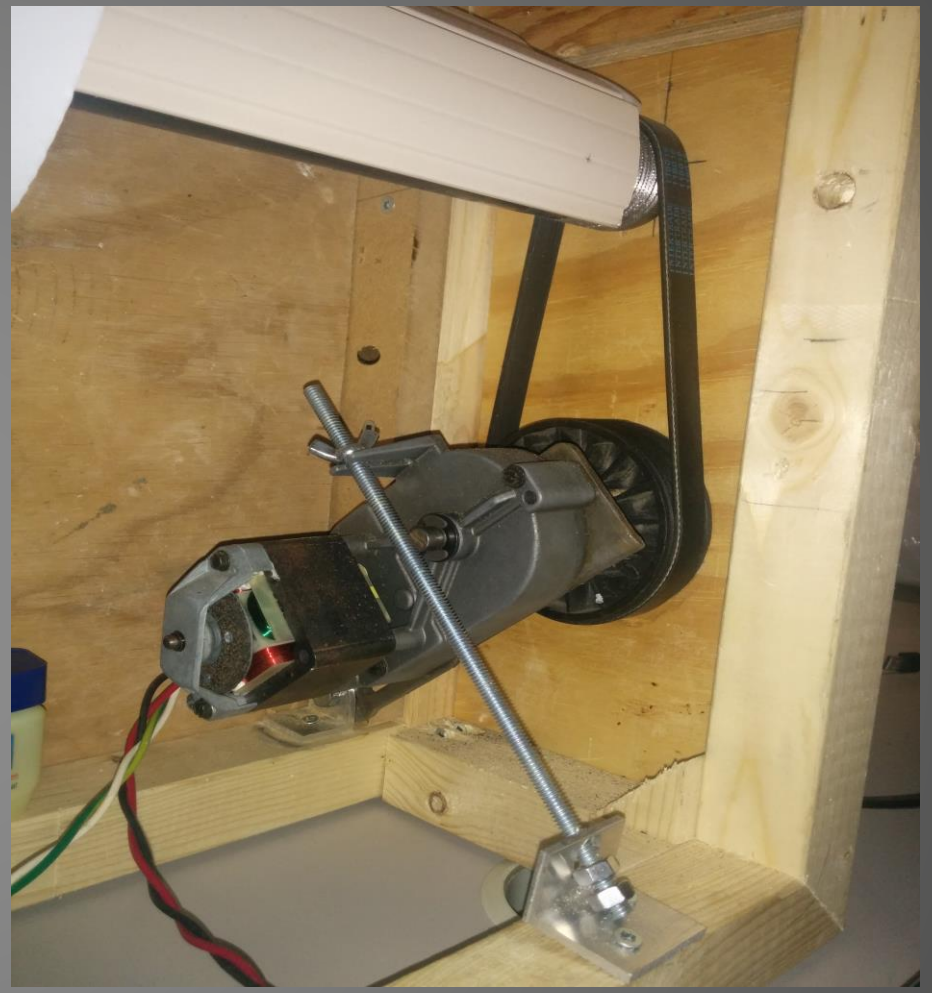
MOTOR CONTROL

- Two repurposed used treadmill motors (drive and incline)
- Also a used roller, pulley
- Belt taken from drive motor



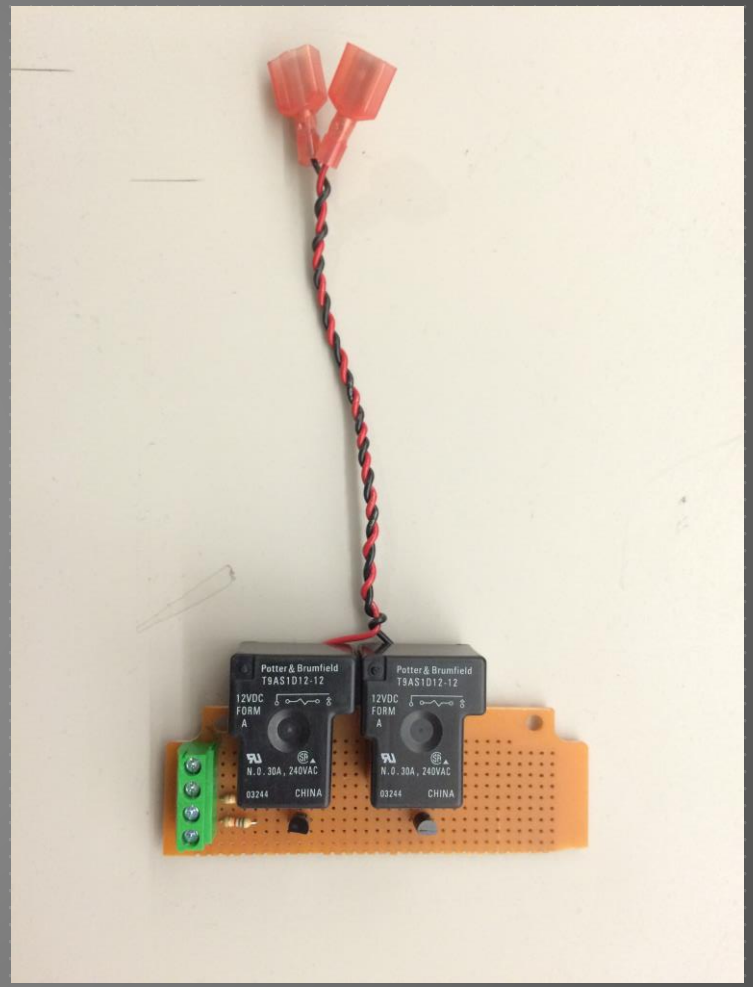






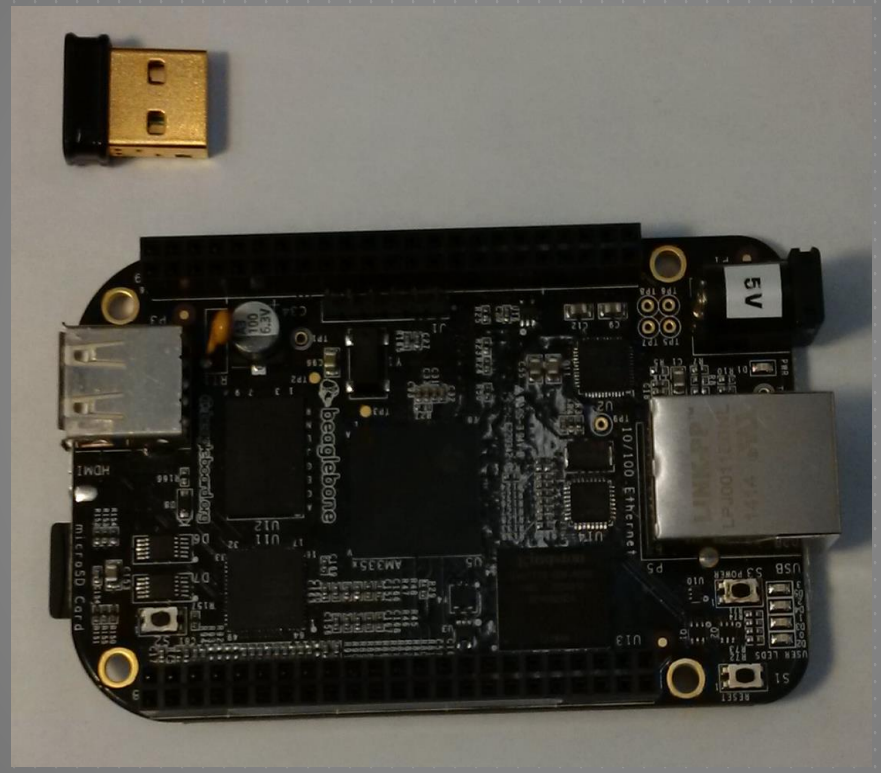
MOTOR CIRCUITRY

- AC-DC relays
- Transistor choices

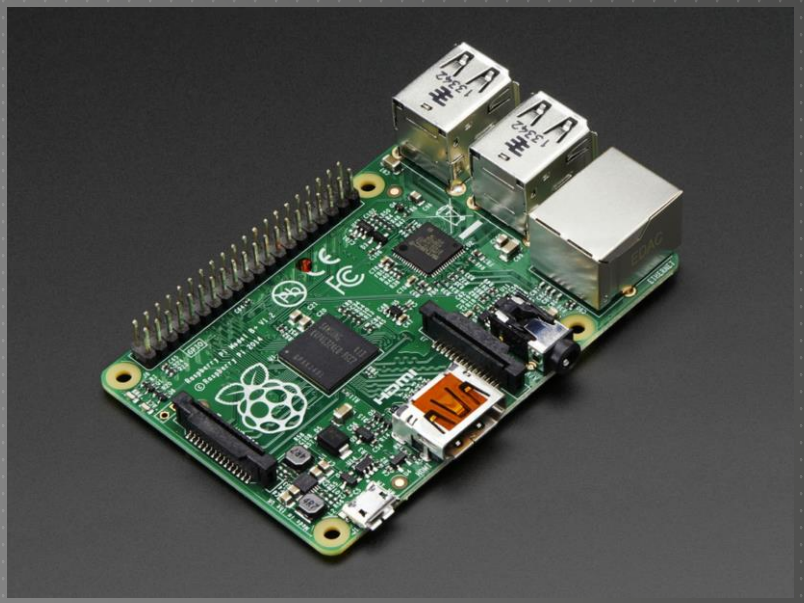


EMBEDDED PLATFORM CONSIDERATIONS

Arduino Mega



Beaglebone Black

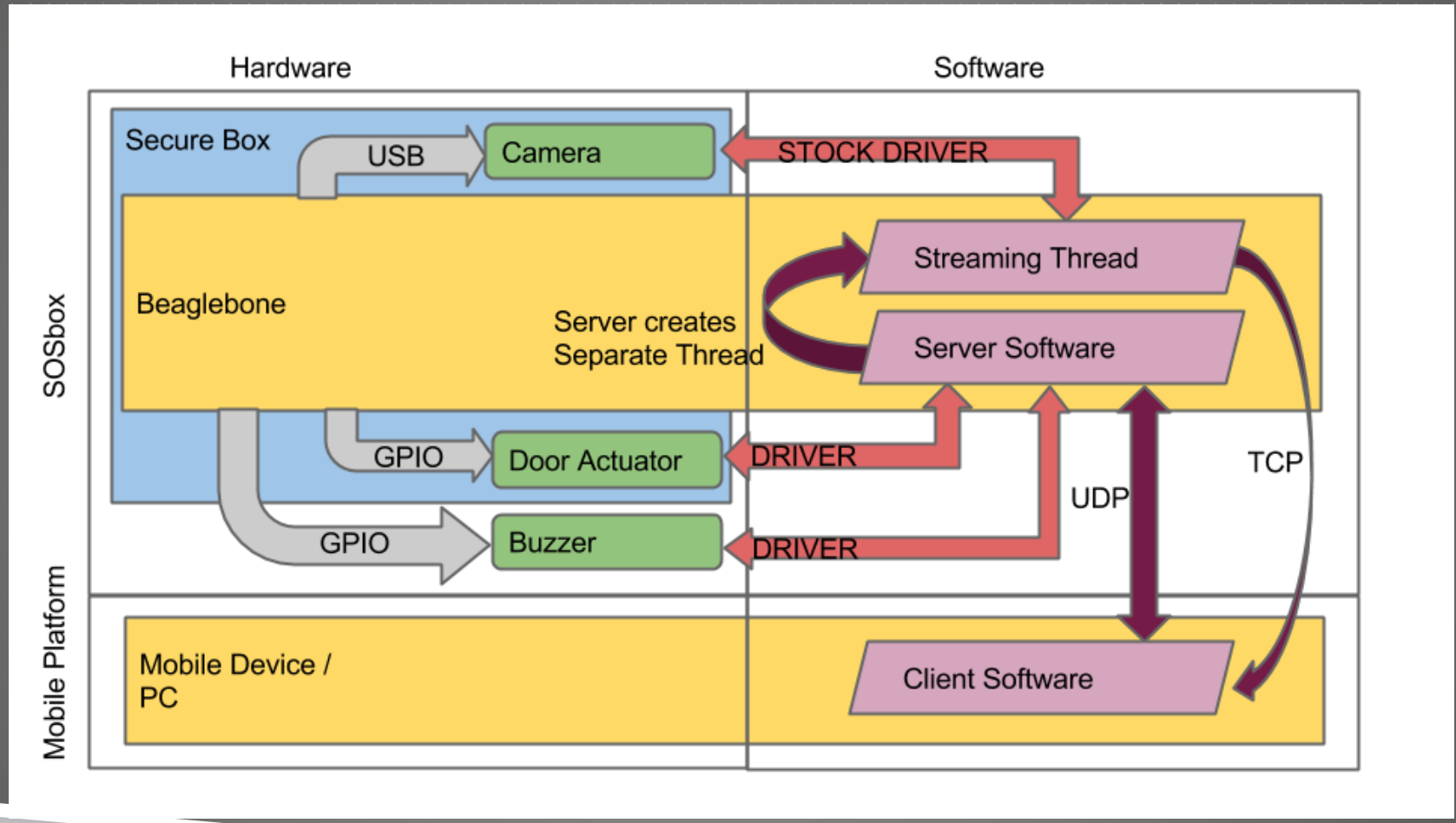


Raspberry Pi Model B+

WHY BEAGLEBONE BLACK ?

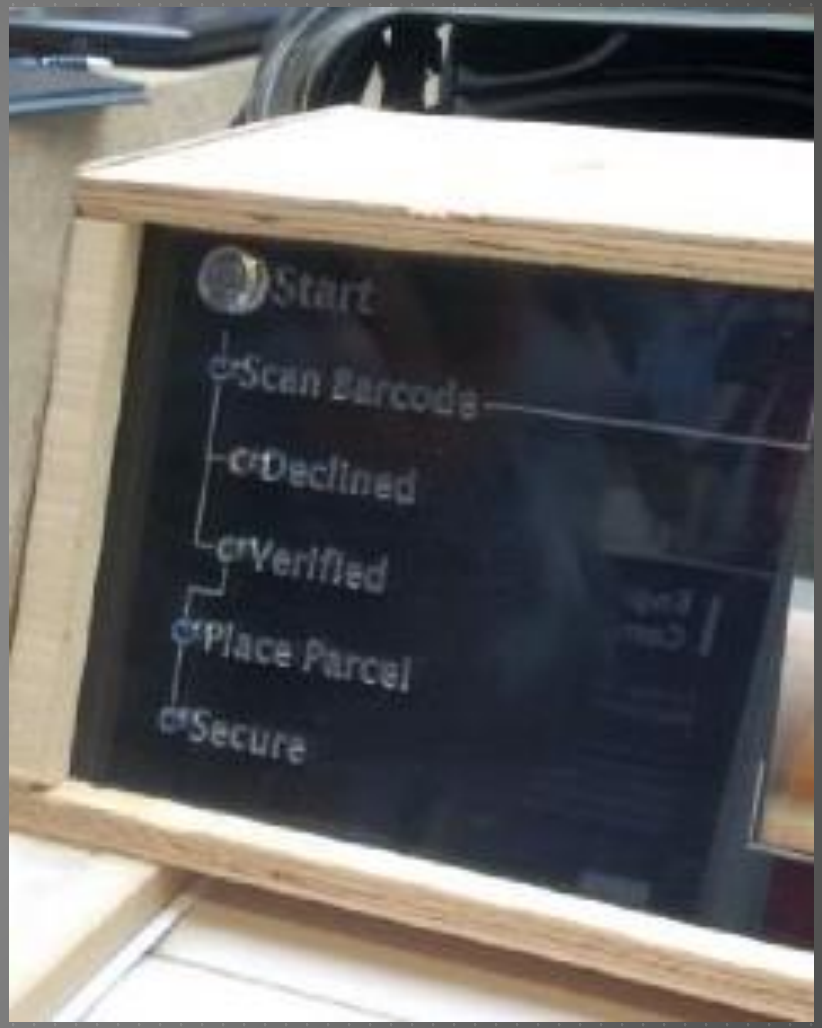
- Much faster processor when benchmarked (1Ghz vs 700Mhz for the Raspberry Pi)
- Onboard 2GB flash memory + SD card expandability
- Total 92 possible connections (65 GPIOs vs 27 for Raspberry Pi B+)
- 7 Analog inputs (None for Raspberry Pi)
- 3 I2C buses vs 1 for Raspberry Pi
- 8 PWM (None for Raspberry Pi)
- 4 timers (None for Raspberry Pi)
- Programming Language flexibility (Python, C, C++ etc…)
- Operating System flexibility (Linux, QNX, etc…)
- Networking Capability
- Ease of Setup and Size
- Cost

SOFTWARE


Hardware
Software
SOSbox
Mobile Platform
Secure Box
USB
Camera
STOCK DRIVER
Beaglebone
Server creates
Separate Thread
Streaming Thread
Server Software
GPIO
Door Actuator
DRIVER
GPIO
Buzzer
DRIVER
UDP
TCP
Mobile Device /
PC
Client Software

UI AND SOSbox INTERACTION

- Interactive display based on usability goals
- Intuitive and easily recognized feedback
- Basic and meaningful interactions to new users
- Basic feedback elements based on convention
- Mostly automated box requires little know-how



PATTERN RECOGNITION

- Works with any barcode or QR code
- Multiple barcode storable on server
- Feedback quick and accurate for wrong barcodes
- Rendered image of code is modified with certain variations in parameters such as resolution and saturation for accuracy
- Codes sent from phone to match with codes scanned at Box

VIDEO STREAMING

- Video Streaming was Implemented from the Embedded System to the Mobile App
- Unfortunately due to Library conflicts we were unable to run both the Pattern Recognition and the Stream Simultaneously
- While conceptually possible to implement them together (only running one at a time) the reality created unintuitive behaviors for both end-users and was scrapped
- We decided pattern recognition was more important and moved the video stream to a separate part of the demo

SOSapp

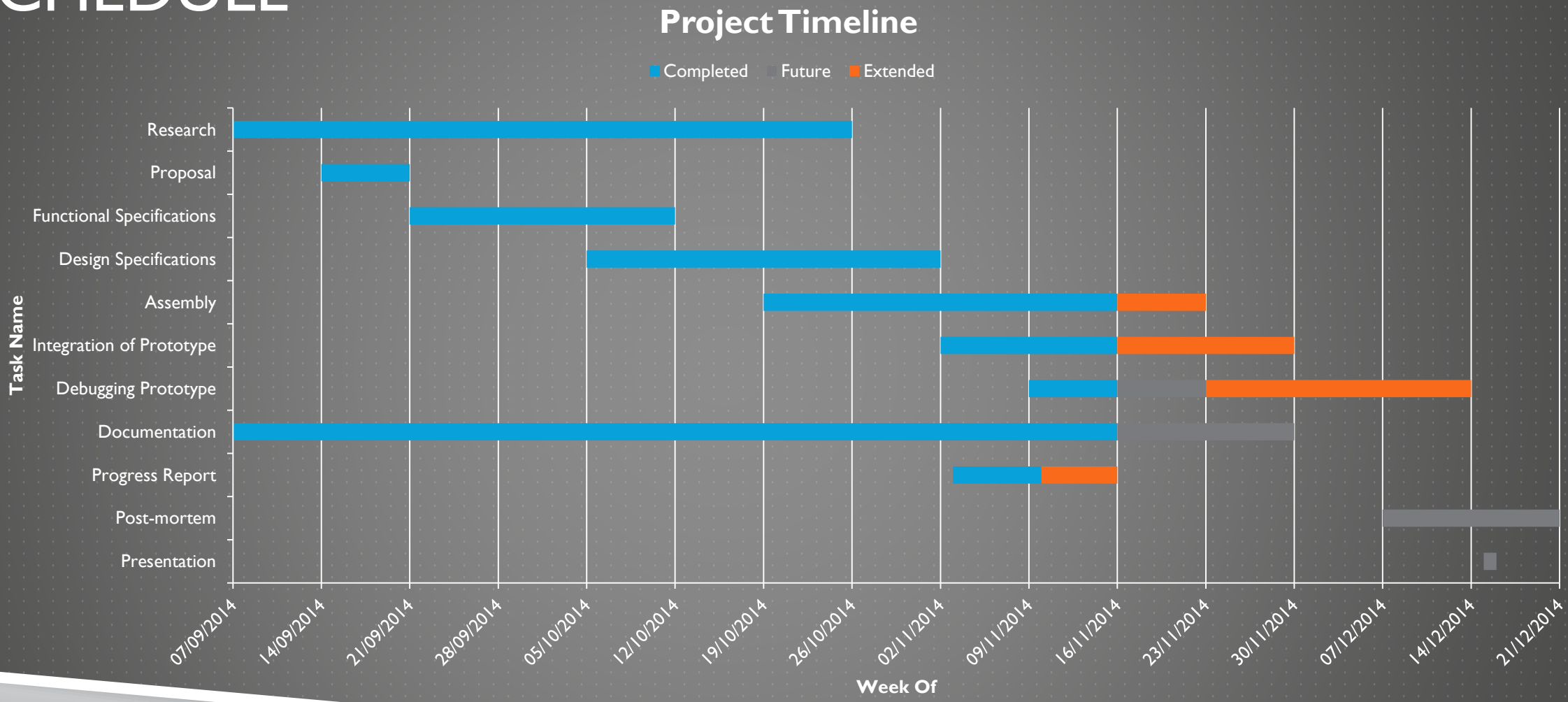
- Used to set barcodes for acceptance
- Feedback to client side for potential problems
- Manual open and close of door
- Video stream viewing from app
- Simple and direct usage

BUDGET

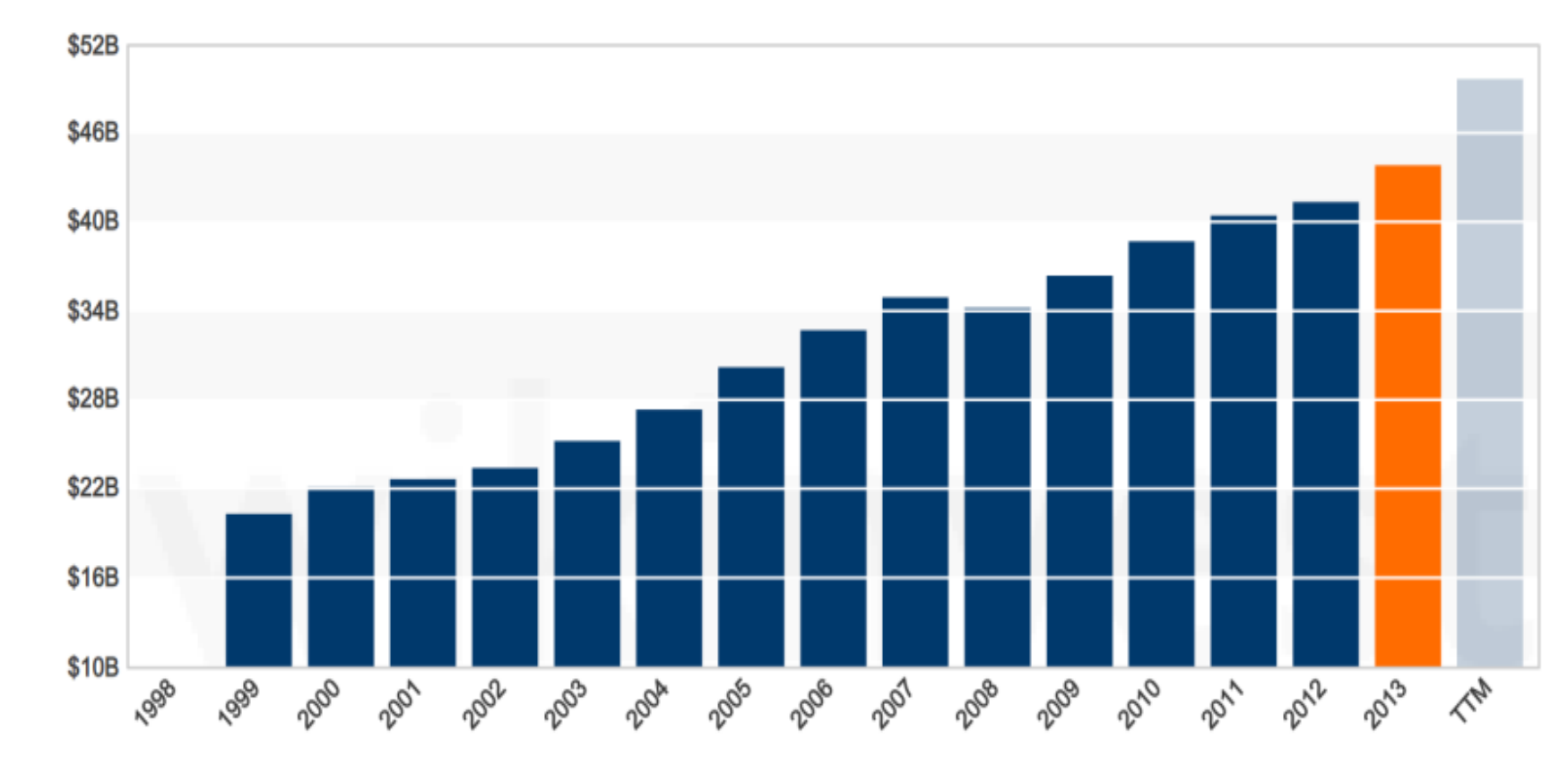
Table 1: SOSbox Budget (PoC)

Components	Estimated Cost ($)	Actual Expenditure ($)
Beaglebone Black kit	150	100
Electronic components (ie sensors, buttons, motors etc..)	100	200
Peripheral & Accessories	50	50
Box Construction	100	100
Miscellaneous Costs (Shipping, import duty etc..)	50	50
Contingency	100	0
Total Cost	550	500

SCHEDULE

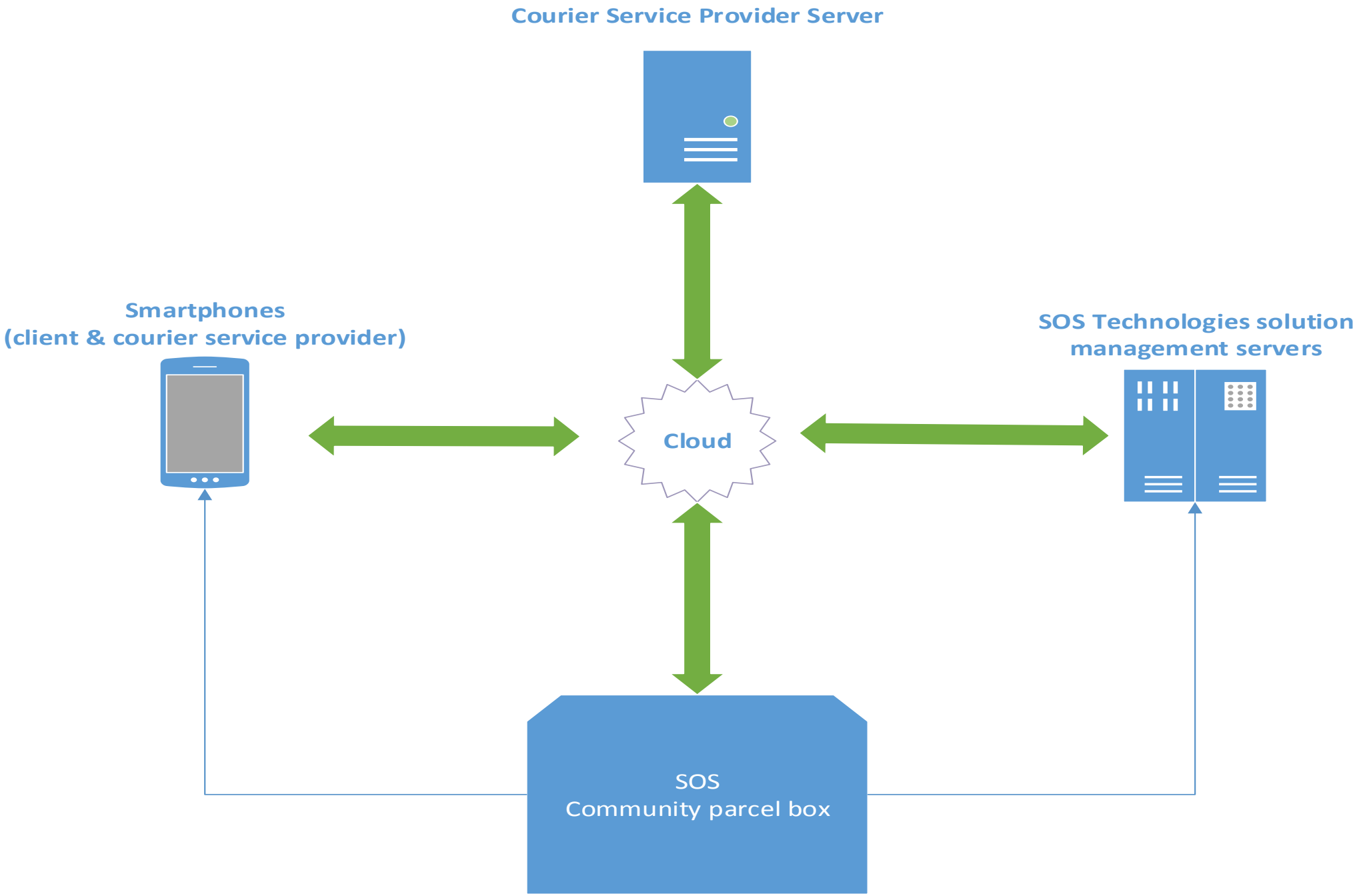

Project Timeline
Completed
Future
Extended
Task Name
Research
Proposal
Functional Specifications
Design Specifications
Assembly
Integration of Prototype
Debugging Prototype
Documentation
Progress Report
Post-mortem
Presentation
07/09/2014
14/09/2014
21/09/2014
28/09/2014
05/10/2014
12/10/2014
19/10/2014
26/10/2014
02/11/2014
09/11/2014
16/11/2014
23/11/2014
30/11/2014
07/12/2014
14/12/2014
21/12/2014
Week Of

MARKET POTENTIAL



MARKET POTENTIAL

- In today's rapidly changing world economy, the way consumers interact with merchants is evolving.
- The emergence of online shopping in Canada and globally has led to a substantial rise in the number of parcels delivered by courier services.


Courier Service Provider Server
Smartphones
(client & courier service provider)
Cloud
SOS Technologies solution
management servers
SOS
Community parcel box

CONCLUSION

- Through this project we gained significant experience and knowledge in product planning and development.
- We implemented a custom solution from concept to working product in under 4 months.
- We stayed within budget and met all of our proof of concept design goals.
- In the future, we intend to explore the commercial prospects of the SOSbox and possibly expand the project to design and build a proof of concept SOShub solution to manage community parcel boxes.

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Andrew Rawicz (SFU Burnaby)

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CANADA
POST
CANADA
9
10
11
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